

LOWER CARBONIFEROUS GASTROPOD FAUNAS FROM OLD CANNINDAH, QUEENSLAND

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ABSTRACT. Gastropod faunas from Old Cannindah are the lowest found in a Lower Carboniferous sequence of strata, beginning with calcareous subgreywacke and detrital limestones and terminating with reef limestones. Rich faunas of molluscs, brachiopods, and corals occur throughout. The gastropod faunas include one new genus *Austroworthenia*, and six new species, as well as an indeterminate one—*Euphenites minutus*, *Waagenella microstriata*, *Straparolus australis*, *S. subdiouysii*, *Austroworthenia levis*, *Loxonema lanellosa*, and *Phymatifer* sp. indet. The species have strong affinities with European forms of late Tournaisian-early Viséan age.

INTRODUCTION

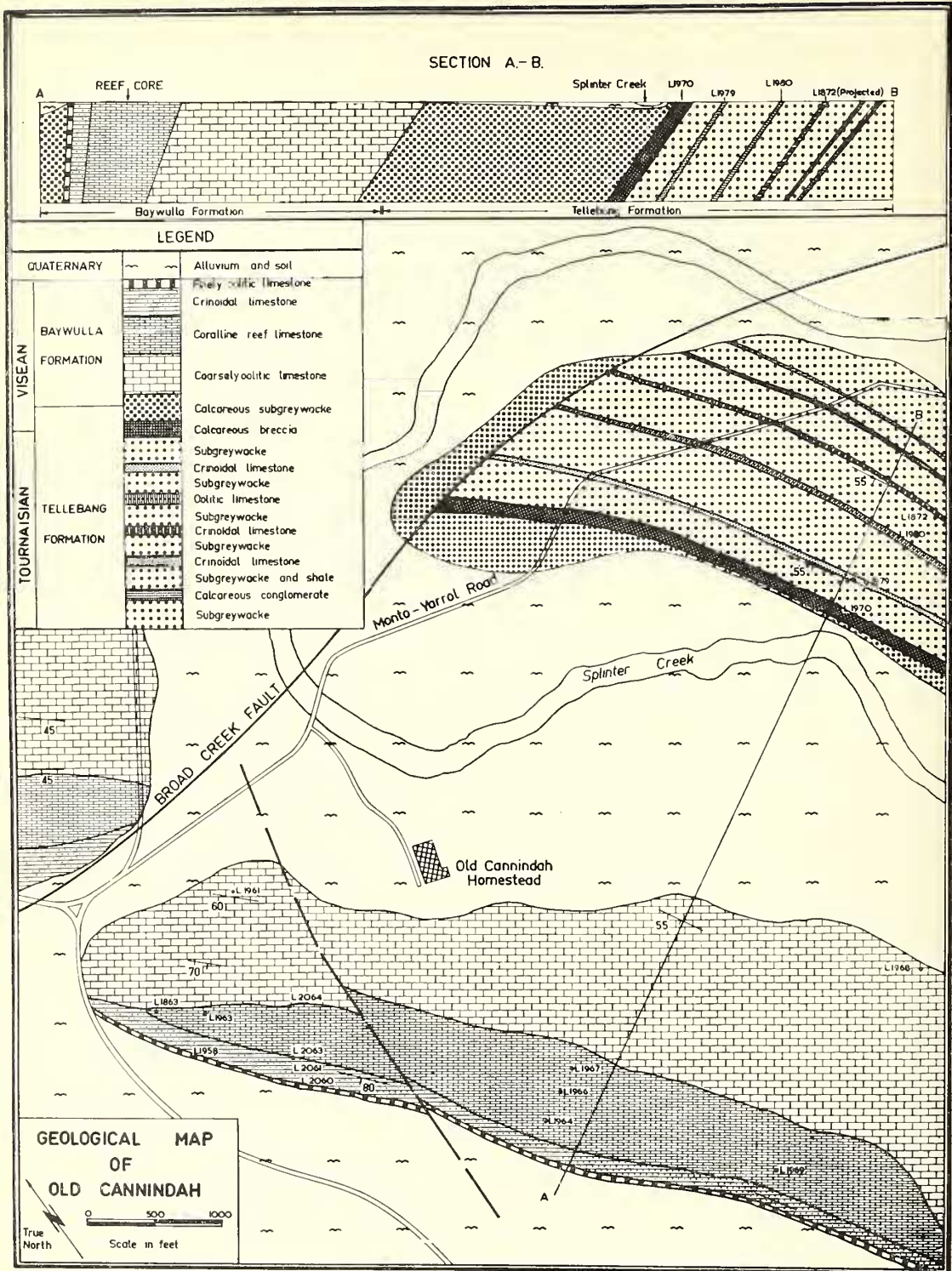
THE present work deals with two small gastropod faunas, of Lower Carboniferous age, found near the western margin of the Yarrol Basin. It represents a contribution to the larger project of biostratigraphic research on the Yarrol Basin, initiated by Hill in 1934 and continued since by members of the University of Queensland.

I am indebted to Professor D. Hill for valuable discussion and for her critical reading of the manuscript. Helpful advice from Dr. K. S. W. Campbell is also acknowledged. Photographs were taken by Mr. Chadwick and the map was drawn by Mr. A. Smith, both of the University of Queensland. The work was financed by a Research Grant held within the University of Queensland.

Stratigraphy. The Yarrol Basin (Hill 1951) consists of a narrow belt of Upper Palaeozoic strata, extending from Mackay, south-south-eastward to Mundubbera, a distance of more than 400 miles. Maximum width of the basin is 50 miles. Marine sedimentation began in the Middle Devonian (Givetian) and terminated early in Permian (Sakmarian), and except for interruptions in the marginal regions, a complete Upper Palaeozoic marine sequence has been preserved over a large part of the basin.

In the central western area of the basin, on Old Cannindah Station, the Tellebang and Baywulla formations, of Tournaisian and Viséan age respectively, reach a thickness of 5,000 feet. The Tellebang formation consists of shale and subgreywacke in its lower part, with thin bands of oolitic and non-oolitic limestone interbedded with calcareous subgreywacke, in the higher part. Fossils are abundant in the calcareous subgreywacke and become more numerous towards the top of the formation. The main gastropod assemblage, which is associated with a rich brachiopod fauna, occurs in a coarse calcareous breccia. The smaller gastropod fauna is preserved in a dark, fine-grained limestone approximately 750 feet below the breccia.

The Baywulla Formation consists almost entirely of limestone. It begins with 1,000 feet of coarsely oolitic limestone containing sparse brachiopods, solitary corals, and crinoidal debris, followed by non-oolitic, reef limestone which reaches a maximum thickness of 600 feet and contains abundant compound corals, of Viséan (D_1 - D_2) age. Non-oolitic, crinoidal limestone, rich in solitary corals, cover the reef core for approxi-



TEXT-FIG. 1. Geological map of Old Cannindah, showing localities from which faunas have been collected.

mately 300 feet, and the top of the formation is defined by a thin band (10 feet) of finely oolitic limestone rich in *Palaeacis* and with less numerous *Daviesiella*.

Faunas and localities. The higher fauna described in this paper occurs at L.1970 immediately west of Splinter Creek. It contains *Euphemites minutus* sp. nov., *Straparolus australis* sp. nov., *Phyuatifer* sp., *Austroworthenia levis* sp. nov., and *Loxonema lamellosa*. In addition to the gastropods, a rich brachiopod assemblage is present, and this is being described in a separate work. The lower fauna, found at L.1872 about 1,100 feet west from L.1970, includes *Waagenella uicrostriata* sp. nov. and *Straparolus subdionysii* sp. nov., as well as brachiopods. Other numbers on the map indicate localities from which faunas have been collected. These faunas, now housed in the University of Queensland, are in the process of description, and are dominantly coralline and brachiopodan.

SYSTEMATIC DESCRIPTIONS

Class GASTROPODA Cuvier

Subclass STREPTONEURA Spengel

Order ASPIDOBANCHIA Schweigger

Superfamily BELLEROPHONTACEA Ulrich & Scofield 1897.

Diagnosis. Symmetrical, planispiral, shell evolute, involute, or convolute; umbilicus open or absent; slit and selenizone present; ornament radial and transverse.

Family BELLEROPHONTIDAE M'Coy 1851

Diagnosis. Symmetrical, moderately thick shell, with wide, oval or elongate aperture; deep median slit on outer lip of aperture, and slit band or keel dividing rest of shell into two equal parts.

Genus EUPHEMITES Warthin 1930

Type species by selection of Waagen (1880, p. 131) *Bellerophon urei* Fleming 1828, p. 338; from Brankumhall Quarry, 1 mile north-east of East Kilbride, Lawrieston, Scotland; Lower Limestone, Hosie Group; Lower Carboniferous.

Diagnosis. Shell thick, globose, with rounded dorsum; dorsal lip bilobed; narrow slit and selenizone; parietal inductura extensive; 20–26 revolving costae well developed; early stage without umbilicus, later stages umbilicate.

Remarks. Knight (1941, pp. 122–3) and Weir (1931, pp. 841–55) have described the type species, *Bellerophon urei* Fleming, in detail, and Weir has identified and described other specimens from the type locality. Although the holotype of *B. urei* has been lost, Weir's interpretation of the species seems to be based on reliable evidence, and is followed in the present work.

In Europe the genus is represented by two species in the lower part of the Tournaisian (Z_2 zone), becomes abundant in the Viséan, and ranges into the Namurian. The type species occurs in the Scottish sequence in Coral Zones 2 and 3 and goniatite zones P_1 , P_2 , and E_1 . The Namurian–Viséan boundary is fixed at the P_2 – E_1 junction. Weir (1931, pp. 841–55) and Demanet (1941, pp. 263–4) have described the European species.

Several species have been described from the Mississippian and Pennsylvanian of North America, in beds of post-Tournaisian age.

Euphemites minutus sp. nov.

Plate 7, figs. 1-4

Holotype. F. 28610 Univ. Qld. Collection; from L. 1970 between Splinter Creek and Mt. Cannindah Portion 91, Parish Cannindah, County Yarrol, Queensland; Late Tournaisian-early Viséan.

Description. This is a small, globular, thin-shelled form, with minute umbilicus. The umbilical depression is narrow and deep. The anterior portion of the shell has not been preserved, and so the characters of the aperture are not known. In cross section, the whorl is transverse oval, slightly flattened, and extended laterally, towards the umbilicus. The ornament consists of well-marked linear ribs separated by wider, flat based grooves, and finer concentric growth-lines. Ribs vary from twelve in the early stages, to sixteen in later stages. The selenizone is narrow and inconspicuous, and is bordered by two ribs slightly higher than the others.

Remarks. *E. minutus* is characterized by its small size and comparatively coarse ornament. It differs from *E. urei* in the possession of fewer ribs and a less conspicuous selenizone. Its closest affinities are with *E. urei* var. *hindi* from Scotland, but this differs in having a closed umbilicus. The American species *E. lenticoforuis* Weller from the Mississippian and *E. nodocarinatus* Hall from the Pennsylvanian differ markedly in shape and ornament. *E. vittatus* McChesney from the Pennsylvanian is similar in shape but has tuberculate ornament on the umbilical slopes.

E. minutus occurs in a calcareous grit, below the Viséan (D₁-D₂) reef limestones of Old Cannindah. Its associated brachiopod-gastropod fauna is suggestive of a late Tournaisian-early Viséan age.

Genus WAAGENELLA de Koninck 1883

Type species by selection of de Koninck (1883, p. 123): *Bellerophon dumonti* d'Orbigny 1838, pl. 2, figs. 16-20 from Visé, Belgium; Viséan, Lower Carboniferous.

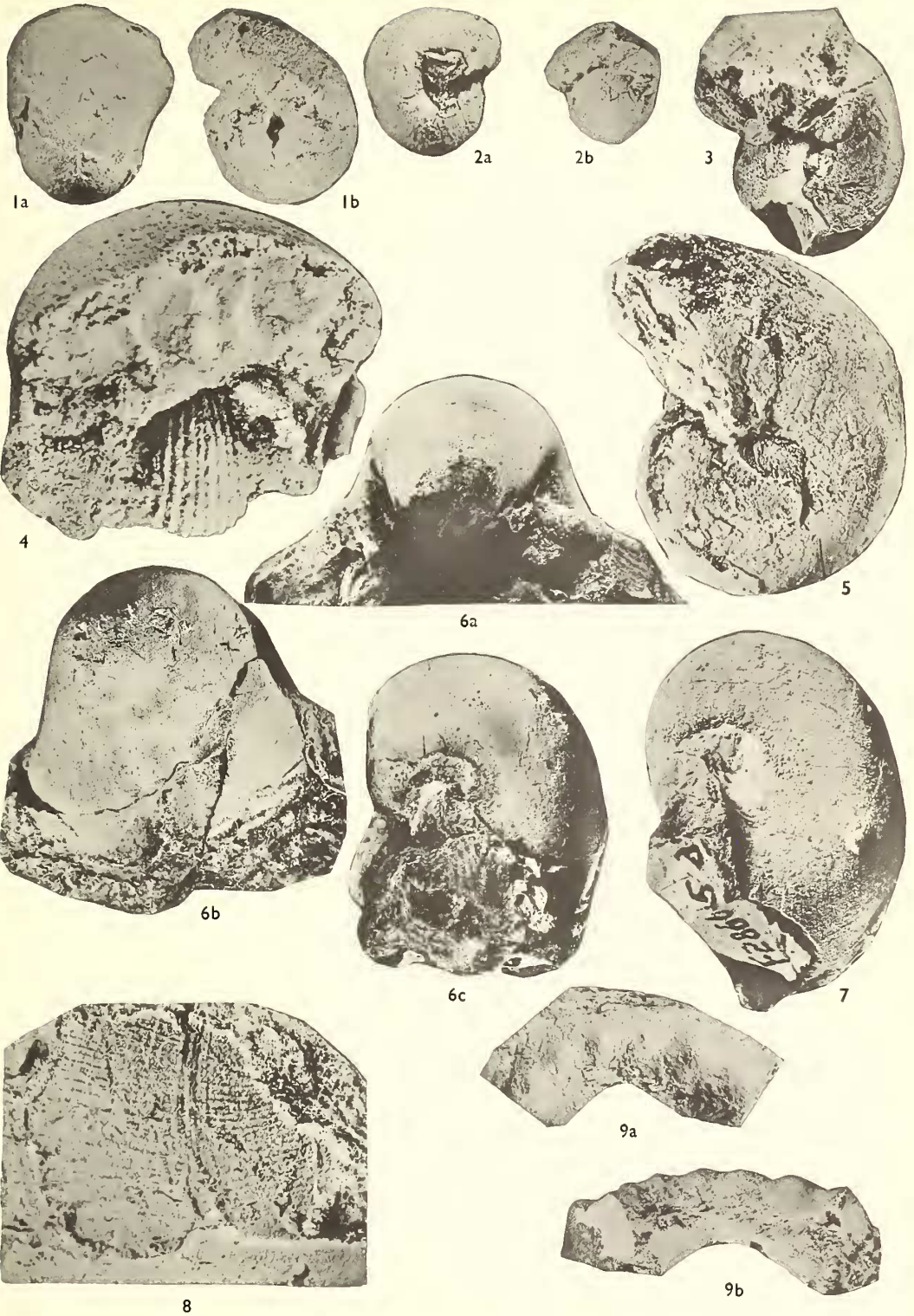
Diagnosis. Subglobose, involute shell, with regularly arched dorsum and large semilunate callosities curving back from the aperture margins over the umbilical region; umbilicus

EXPLANATION OF PLATE 7

Figs. 1-4. *Euphemites minutus* sp. nov., Tellebang Formation, L. 1970, Por. 91, Parish Cannindah. 1a, Periphery and outer whorl, holotype (F. 28610), $\times 2$. 1b, Apical view of same specimen. 2a, Apical view (F. 28612), $\times 2$. 2b, Apertural view (F. 28613), $\times 2$. 2c, Peripheral view, $\times 2$. 3, Apical view (F. 28613), $\times 2$. 4, Apertural view with part of whorl removed to show revolving striae on earlier whorl (F. 28611), $\times 6$. 5, Apical view (F. 28612), $\times 3.5$.

Figs. 6-8. *Waagenella microstriata* sp. nov., Tellebang Formation, L. 1872, Por. 91, Parish Cannindah. 6a, Inner whorl profile and aperture, holotype (F. 28666), $\times 2$. 6b, Periphery and outer whorl, $\times 2$. 6c, Apical view, $\times 2$. 7, Apical view (F. 28665a), $\times 2$. 8, Part of external mould (F. 28665b) showing selenizone and fine transverse striations, $\times 3.5$.

Fig. 9. *Phymatifer* sp. Tellebang Formation, L. 1970, Por. 91, Parish Cannindah. 9a, Part of upper surface of whorl showing strong nodes (F. 28649). 9b, Same specimen, oblique view (nat. size).



closed; outer lip with broad shallow sinus, with central slit; narrow slightly raised selenizone, bordered by strong lirae; growth-lines fine, sharp; revolving costae fine.

Remarks. de Koninck (1882, p. 81) proposed the name *Waagenia* for species with reflected semilunate callosities at the margin of the aperture, and in 1883 (p. 123) indicated *Bellerophon dumonti* d'Orbigny as the type species. However, in a footnote to the explanation of his plate 38 (1883) he stated that the name *Waagenia* was pre-occupied for an ammonoid genus and so he introduced the new name *Waagenella* for his bellerophontid genus.

Weir (1931, p. 813) quoted *Bellerophon ferussaci* d'Orbigny 1840 as the type species, apparently unaware of de Koninck's previous designation. Knight (1941, pp. 383-4) redescribed and figured the holotype of *B. dumonti* d'Orbigny from Visé, Belgium, and the present interpretation of the genus is based largely on Knight's description.

In his comprehensive study of the British and Belgian Carboniferous Bellerophontidae, Weir (1931, pp. 753-861) recognized six genera, viz.: *Bellerophon* de Montfort, *Waagenella* de Koninck, *Bucaniopsis* Ulrich, *Patellostium* Waagen, *Tropidocyclus* de Koninck, (= *Tropidodiscus* Meek & Worthen), *Zonidiscus* Spitz, and *Euphemus* M'Coy (= *Euphemites* Warthin), as well as minor groups within these. Generic distinction was based mainly on the nature of the aperture and inductura, the nature of the selenizone, and surface ornament. Shell shape (whorl cross-section) described by Weir appears to be quite variable within each genus, although Weir separated groups of species mainly on this character.

Examination of the holotype figured by Knight (1941) has shown that in many cases, the characters of generic importance—aperture, selenizone, surface ornament—are not preserved, and consequently interpretation of the type species and their respective genera is both difficult and not wholly reliable.

In the case of *Waagenella*, the author has supplemented Knight's description of the type species with material figured by de Koninck from the same locality. De Koninck's figures illustrate the finer surface ornament, which is not apparent on d'Orbigny's original specimen, and which is regarded by the present author as having generic significance.

Except for *W. portlocki* de Koninck, a small form found in the Upper Tournaisian, *Waagenella* in Belgium and Britain is restricted to beds of Viséan (S-D₂ zones) age. In North America *Bellerophon crassus* Meek and Worthen from the Pennsylvanian is the species with closest affinities to *Waagenella*.

Waagenella microstriata sp. nov.

Plate 7, figs. 6-8

Holotype. F. 28666 Univ. Qld. Collection; from L. 1872 between Splinter Creek and Mt. Cannindah, Portion 91, Parish Cannindah, County Yarrol, Queensland; Tournaisian.

Description. The shell is of medium size and globular shape, with the whorl widening rapidly towards the aperture. The aperture is transversely elliptical, and its lateral margins are extended and curved backwards over the umbilical region. The inner lip is somewhat thickened. A slightly raised selenizone extends posteriorly from the centre of the outer lip. Fine concentric growth-lines curve across the surface from the umbilical

regions, meeting the selenizone more or less at right angles. Intersecting the growth-lines are small regular striae, parallel with the selenizone, and averaging thirty per 10 mm. on the dorsum.

Remarks. *W. microstriata* is characterized by its expanding whorl diameter and its finely striate surface ornament. Its closest affinities are with *W. dumonti* figured by de Koninck (1883, pl. 35, figs. 11–14) from the Carboniferous limestone of Visé. De Koninck's specimen is somewhat more globose than *W. microstriata*, but both have similar surface ornament. *Bellerophon stanvellensis* Etheridge (1892), from the Lower Carboniferous beds of the Stanwell district, probably belongs to the genus *Waagenella*. It is readily distinguished from *W. microstriata* by its much greater size, coarser growth-lines, absence of revolving striae, relatively smaller selenizone, and less rapidly expanding whorl width. Etheridge's type specimen has the recurved, much thickened apertural margins of *Waagenella*. Another, undescribed species of *Waagenella* has been found in the Lower Carboniferous beds of Delgalgil Creek, north of Monto in the Glassford district. This species is similar to *Bellerophon stanvellensis*, but is much smaller in size, has growth-lines curving backward from the selenizone, which is higher than that of *B. stanvellensis*. The exact locality and age of Etheridge's specimens from Stanwell and the age of the Delgalgil Creek species are not known. *W. microstriata* has been found only at the one locality so far. It occurs in a limestone, below the main reef development at Old Cannindah. Its associated fauna as well as its affinities with European species suggest a Tournaisian age.

Family EUOMPHALIDAE de Koninck 1881

Diagnosis. Low spired, discoidal to subtrochoidal, dextrally coiled shell; wide umbilicus; whorls rounded or angular; sinus in the upper part of the outer lip; ornament of concentric growth-lines, and in some genera, revolving striae.

Remarks. The euomphalids range from the early Palaeozoic to Cretaceous, reaching their maxima in the Devonian–Carboniferous and in the Triassic. The Carboniferous genera are characterized by the disappearance of the sinus and the tendency towards angularity in whorl cross-section. Further development of this tendency results in the appearance of nodes on the shoulders of the whorls.

Knight (1934, pp. 142–5) recognized only one Carboniferous genus, *Straparolus* Montfort 1810, and one subgenus *Euomphalus* Sowerby 1812 in the Euomphalidae, and he referred the genera *Schizostoma* Bronn 1834, *Phymatifer* de Koninck 1881, and *Phanerotinus* Sowerby 1844 to the synonymy of *Straparolus*. The main variation within the family Euomphalidae appears to be in shell form and whorl contour. *Straparolus* has the most trochiform shell, with evenly arched whorls, *Euomphalus* has a low, coiled shell, with angulation of the whorl and a tendency towards nodal development. If such differences are of generic value then *Phymatifer* de Koninck 1881 can be separated on the basis of nodal development on the upper shoulders of its whorls, and on its discoidal, depressed shell. *Phanerotinus* Sowerby can be distinguished by its open coiling and leaf-like expansions of the outer whorl. The shell of *Schizostoma* Bronn is similar to that of *Euomphalus* but the whorls are more angular. In view of their differences, it would seem advisable to accept the generic status of these forms.

Genus STRAPAROLUS de Montfort 1810

Type species by original designation *Straparolus dionysii* Montfort 1810, p. 174, from Namur, Belgium; Lower Carboniferous.

Diagnosis. Subdiscoidal to subtrochiform shell, with nucleus flatly coiled; rounded whorls, wide umbilicus; low, revolving ridge on upper whorl surface, and sutures at line of contact of whorls, parietal lip with thin inductura, outer lip bent slightly backward to form weak sinus; ornament of fine growth-lines and fine revolving lirae.

Remarks. The genus has been treated exhaustively by Knight (1934; 1941; 1947), who has given its range as Devonian to Lower Pennsylvanian.

Straparolus australis sp. nov.

Plate 8, figs. 1-4

Holotype. F. 28615, Univ. Qld. Collections; from L.1970 between Splinter Creek and Mt. Cannindah, Portion 91, Parish Cannindah, County Yarrol, Queensland. Late Tournaisian-early Viséan.

Description. The shell is subtrochiform in shape with the first two whorls almost planispiral, and subsequent whorls becoming weakly trochiform. Sutures are relatively deep. Slight angularity of the upper shoulder develops in the later whorls, and this is separated from the upper suture by a somewhat flattened band. The tendency towards angularity is less apparent in the lower shoulder of the later whorls. The umbilicus is wide and steep sided. Ornament consists of numerous fine concentric growth-lines which curve slightly over the upper shoulder; no revolving striae can be distinguished.

Dimensions.

	<i>Holotype</i>	<i>Syntypes</i>
Number of whorls	4	3+ 5
Height of whorl	10 mm.	7 9
Width of whorl	13 mm.	=10 10
Height of shell	17 mm.	
Width of shell	33 mm.	

Remarks. *Straparolus australis* resembles the species identified as *S. dionysii* from the Carboniferous of England and Ireland, but is generally larger and slightly less trochiform. Of the Belgian species, its closest affinities are with *S. explanatus* de Koninck 1881 (p. 125, pl. 21, figs. 5-7) from the Viséan limestones of Visé. Like the type species, its whorls are well arched and not noticeably angular. It differs in this respect from the American species *S. savagei* Knight which has three distinct angular ridges.

An undescribed species of this genus occurs in beds of Tournaisian age in the Rockhampton district, Queensland. This form differs from *S. australis*, in that a row of rounded nodes occurs on the upper shoulder of the whorls, and its shape is less trochiform.

S. subdionysii sp. nov. is the second species which occurs in the limestones between Splinter Creek and Mt. Cannindah. It first appears about 500 feet below the bed with *S. australis*, and is also found associated with *S. australis*. *S. subdionysii* is a smaller, higher shell with distinct revolving bands.

Straparolus subdionysii sp. nov.

Plate 8, figs. 5a-c

Holotype. F. 28637, Univ. Qld. Collection; from L. 1872, between Splinter Creek and Mt. Cannindah, Portion 91, Parish Cannindah, County Yarrol, Queensland; Tournaisian.

Description. The shell is symmetrically coiled, subtrochiform in shape, with a steep-sided umbilicus of moderate width. The whorls are fairly well arched in profile, and separated from earlier whorls by small sutures. A low ridge or shoulder is developed on the upper surface of the whorl, while the lower surface is well rounded. A band consisting of three minute ridges extends along the outer face of the whorl, and is bordered by slight depressions. The ornament consists of fine growth-lines.

Dimensions.

	<i>Holotype</i>	<i>Syntype A</i>
Number of whorls	4	4
Height of whorls	10 mm.	6.5 mm.
Width of whorls	10 mm.	8 mm.
Height of shell	15 mm.	9 mm.
Width of shell	23 mm.	17 mm.

Remarks. *S. subdionysii* has marked affinity with the type species *S. dionysii*, and is distinguished from *S. australis* by its more trochiform shape. It resembles *S. savagei* Knight in the development of the raised band, but differs from the American species in shape. It occurs in beds of Tournaisian age.

Genus PHYMATIFER de Koninck 1881

Type species by selection of Knight 1941, p. 243: *Euomphalus pugilis* Phillips 1836, p. 225; from Bolland, Yorkshire, England; Lower Carboniferous.

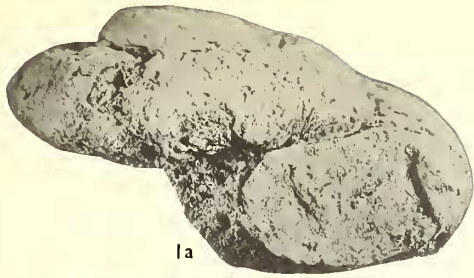
Diagnosis. Discooidal, evolute shell; depressed spire, wide umbilicus; whorls angular, with noses on upper and lower surfaces; suture sharp, deep; ornament of faint growth-lines, slightly curved over nodes.

Remarks. De Koninck (1881, p. 149) erected the genus for species with tubercles developed on the upper and lower surfaces of the whorl. Knight believed that this tendency was apparent in species of *Euomphalus* s.s. and that it was not of generic significance. Consequently he suggested that *Phymatifer* was a synonym of *Euomphalus*. The tuberculate species and the non-tuberculate ones may form a gradational series, but

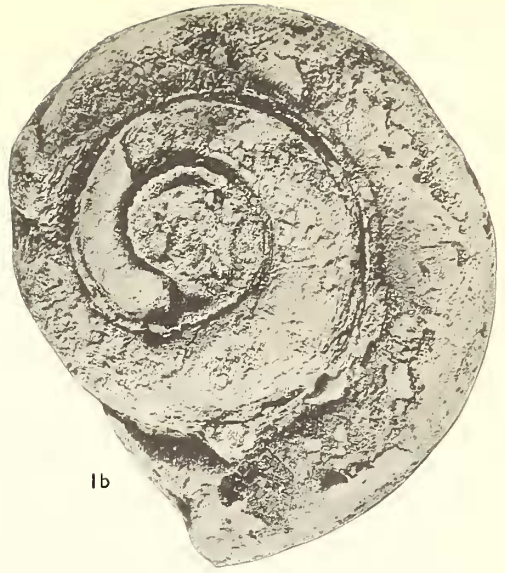
EXPLANATION OF PLATE 8

Figs. 1-4. *Straparolus australis* sp. nov., Tellebang Formation, L. 1970, Por. 91, Parish of Cannindah. 1a, Apertural row and shell profile, holotype (F. 28615), $\times 2$. 1b, Apical view, $\times 2$. 2, Apical view (F. 28618), $\times 2$. 3, Apertural view and shell profile (F. 28617), $\times 2$. 4, Part of whorl showing fine transverse striation, $\times 2$.

Figs. 5a-c. *Straparolus subdionysii* sp. nov., Tellebang Formation, L. 1872, Por. 91, Parish Cannindah. 5a, Apertural view and shell profile, holotype (F. 28637), $\times 2$. 5b, Apical view, $\times 2.25$. 5c, Shell profile, $\times 2.5$.



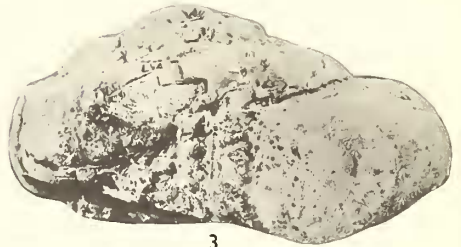
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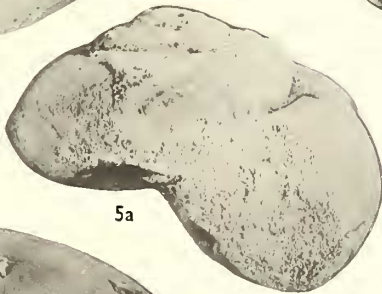
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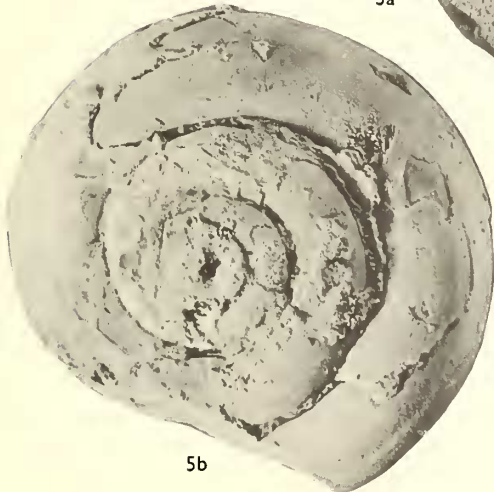
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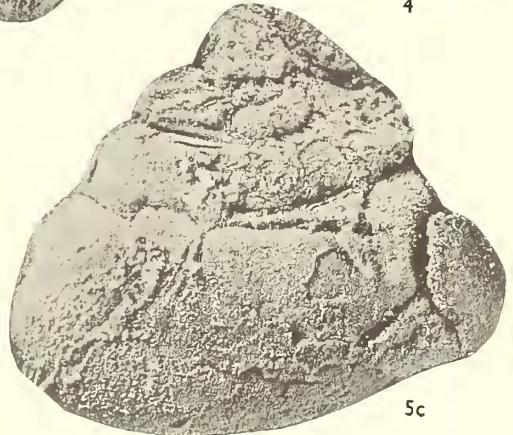
5a



4



5b



5c

